

lower upper portion of the steering column with the lower portion of the steering column. Additionally, when module 22 with a mechanically connected steering wheel 24 is removed, compensation for removal of the steering wheel's inertia is desirable. Such compensation can be achieved by installing a rotational inertia mass on the lower portion of the column, and/or by compensating for the inertia change with software for the steering system actuator. A multi-pin connector electrically connects airbag 28 with a vehicle electric signal bus (not shown).

[0017] When the steering system is a steer-by-wire system, an exemplary module 22 includes a combination of a feedback motor, sensors, and a bearing-mounted stub shaft. An exemplary electrical connector such as multi-pin plug and socket connector is provided between module 22 and dashboard 18 and serves as the steering wheel connector. A module side 33 of the connector is illustrated in FIG. 7, extending by an electrical cable from base 25. Module side 33 mates with a dashboard side 35 of the connector, illustrated in FIG. 9. The electrical connector provides electrical connections for both airbag 28 and the steer-by-wire system. The connector is disconnected with the unplugging of dashboard side 35 from module side 33, in association with removal of module 22 from dashboard 18 and is connected with the plugging of dashboard side 35 into module side 33 in association with installation of module 22. Each type of steering system requires a compatible steering wheel connector. The appropriate level of convenience and ease of removing and reinstalling module 22 also depends on the use of module 22. When module 22 is only used for vehicle development, and installation and removal is limited to a small number of development vehicles, there is less of a need to make the connector easy or convenient. In such circumstances, highly skilled technicians having a full range of tools and power equipment are typically available to install and extract module 22. The precise details of the connector are not needed in this disclosure because, independent of the nature of the type of steering system employed, a design of a functional connector is within the range of skill of one skilled in the art to provide.

[0018] An exemplary removable pedal module 32, associated with module 22, is removably fixed to vehicle floor 17 to maintain it in a forward position. Alternatives for fixing module 32 to floor 17 include threaded fasteners and spring-loaded snap engagement features. Module 32 includes an accelerator pedal 34 and a brake pedal 36. Displacement of pedals 34 and 36 is detected with electronic displacement transducers incorporated into module 32. An electrical connector such as a multi-pin connector connects module 32 with the vehicle signal bus. Module 32 also includes displacement control features opposing pedal movement in a first direction and restoring pedals to a start position to simulate mechanical connections with a braking system and a drive motor. An exemplary displacement control feature for accelerator pedal 34 is a spring. An alternative feature is an electric actuator operated by software programmed to simulate accelerator pedal resistance and restoring force. An exemplary control feature for brake pedal 36 is a combination of a spring and a gas damper. An alternative feature is an electric actuator operated by software programmed to simulate brake pedal resistance and restoring force.

[0019] FIG. 3, FIG. 4 and FIG. 6 show a portion of vehicle 10 with an exemplary removable filler module 38 in place of the removable steering wheel module 22 and with pedal

module 32 removed. Filler module 38, best seen in FIG. 8, includes a filler module base 39 formed to fit within niche 23, and shaped to be complementary to and consistent in appearance with the rest of dashboard 18. Exemplary base 39 has a substantially line-to-line fit with dashboard 18. Exemplary module 38 includes a dashboard airbag 40 disposed beneath an upper trim panel 41. An inflated airbag 40 is illustrated in FIG. 4. A lower part of module 38 includes a lower trim panel 42. Panel 42 may be incorporated into a pivotable door for a glove box storage compartment 44 integrated into module 38. A selectively engageable filler module mounting mount (not shown), substantially identical to the steering module mount and in an exemplary embodiment, including a filler module mounting rail 46 identical to rail 30, is incorporated into removable filler module 38 for receipt by channel 31 and fixing module 38 to dashboard 18. Rail 46 may be characterized as a first part of the filler module mount.

[0020] Alternative embodiments (not shown) of steering wheel module 22 and filler module 38 are smaller in that they do not include an upper portion of modules 22 and 38 corresponding a section of module 38 in which airbag 40 is disposed. Removable filler module 38 includes lower trim panel 42 and base 39, optionally including a glove box 44. An airbag 40 is not included in the filler module and is instead permanently mounted in dashboard 18. When steering wheel module 22 is installed in dashboard 18, there are two airbags on the driver side: one in the steering wheel and one in the dashboard. System logic stored in an electronic control unit (not shown) deactivates airbag 40 when steering wheel 24 with air bag 28 is installed.

[0021] As used herein, the adverb "substantially" modifying an adjective means that a shape, structure, measurement, value, calculation, etc. may deviate from an exact described geometry, distance, measurement, value, calculation, etc., because of imperfections in materials, machining, manufacturing, sensor measurements, computations, processing time, communications time, etc.

[0022] It is to be understood that the present disclosure, including the above description and the accompanying figures and below claims, is intended to be illustrative and not restrictive. Many embodiments and applications other than the examples provided would be apparent to those of skill in the art upon reading the above description. The scope of the invention should be determined, not with reference to the above description, but should instead be determined with reference to claims appended hereto, along with the full scope of equivalents to which such claims are entitled. Unless otherwise stated or qualified herein, all claim terms are intended to be given their plain and ordinary meanings. It is anticipated and intended that future developments will occur in the arts discussed herein, and that the disclosed systems and methods will be incorporated into such future embodiments. In sum, it should be understood that the disclosed subject matter is capable of modification and variation.

1. A dashboard assembly for a vehicle comprising:

- a dashboard defining a receiving niche alignable with a driver seat location and the niche being selectively fillable by each of a removable steering module and a removable filler module;